JUNE 2, 2020

OVERVIEW OF KEY INSIGHTS FROM SMART MOBILITY 1.0

2020 DOE VEHICLE TECHNOLOGIES OFFICE ANNUAL MERIT REVIEW PRESENTATION

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Mobility

The quality of a network or system to connect people to goods, services, and employment that define a high quality of life.

SMART MOBILITY CONSORTIUM

What is it?

The SMART Mobility Consortium is a multi-year, multi-laboratory collaborative dedicated to further understanding the energy implications and opportunities of advanced mobility solutions.

SMART MOBILITY: OVERVIEW

TIMELINE

- **Project start date:** October 2016
- **Project end date:** September 2019*

BUDGET

- FY2017: $14.1M (inc $3.3M PYC)
- FY2018: $20.5M
- FY2019: $10.1M
- FY2020: $4.2M*

*A subset of SMART Mobility tasks were extended into FY2020.

BARRIERS

SMART Mobility addresses the fundamental challenge of understanding the broad, complex interactions of large-scale transportation networks in the context of the rapid advancement of new mobility technologies and services.

PARTNERS

Argonne National Laboratory

Berkeley Lab

INL Idaho National Laboratory

NREL National Renewable Energy Laboratory

Oak Ridge National Laboratory

U.S. DEPARTMENT OF ENERGY SMARTMOBILITY Systems and Modeling for Accelerated Research in Transportation

FIVE RESEARCH FOCUS AREAS

CONNECTED AND AUTOMATED VEHICLES

Identifying the energy, technology, and usage implications of connectivity and automation and identifying efficient CAV solutions.

MOBILITY DECISION SCIENCE

Understanding the human role in the mobility system including travel decision-making and technology adoption in the context of future mobility.

MULTI-MODAL FREIGHT

Evaluating the evolution of freight movement and understanding the impacts of new modes for long-distance goods transport and last-mile package delivery.

URBAN SCIENCE

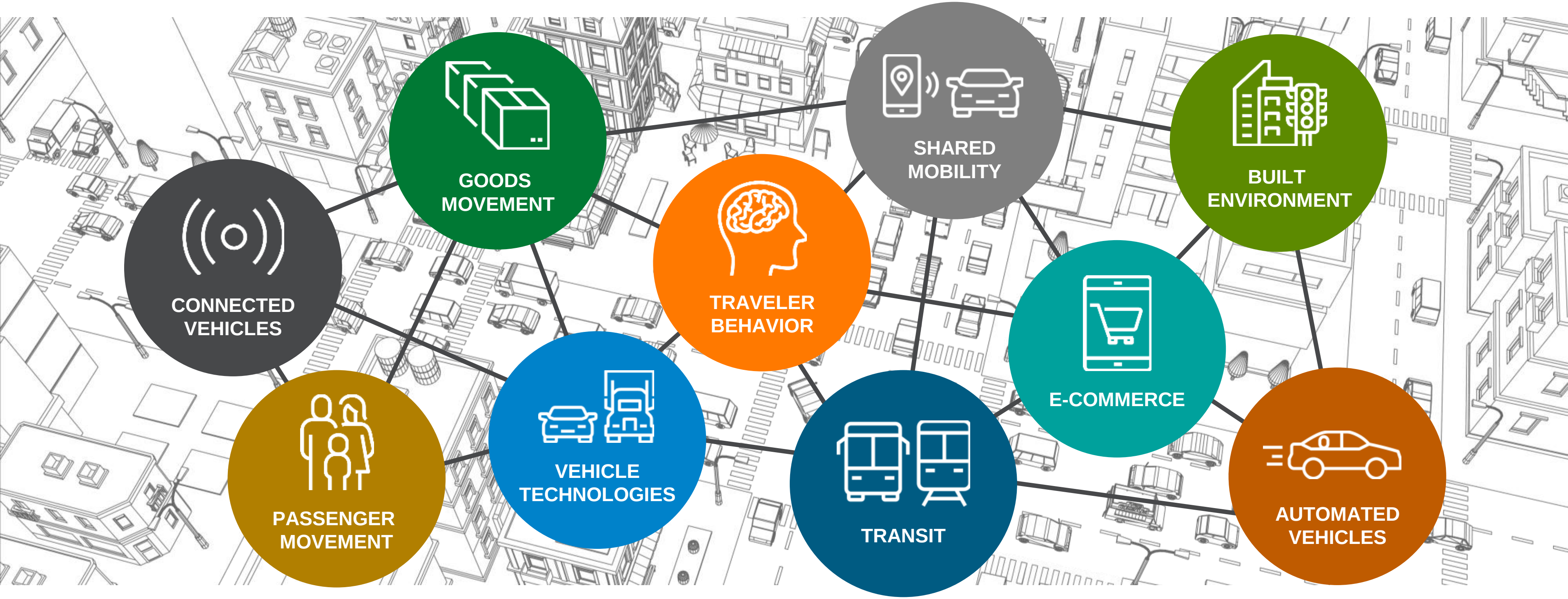
Understanding the linkages between transportation networks and the built environment and identifying the potential to enhance access to economic opportunity.

ADVANCED FUELING INFRASTRUCTURE

Understanding the costs, benefits, and requirements for fueling/charging infrastructure to support energy efficient future mobility systems.

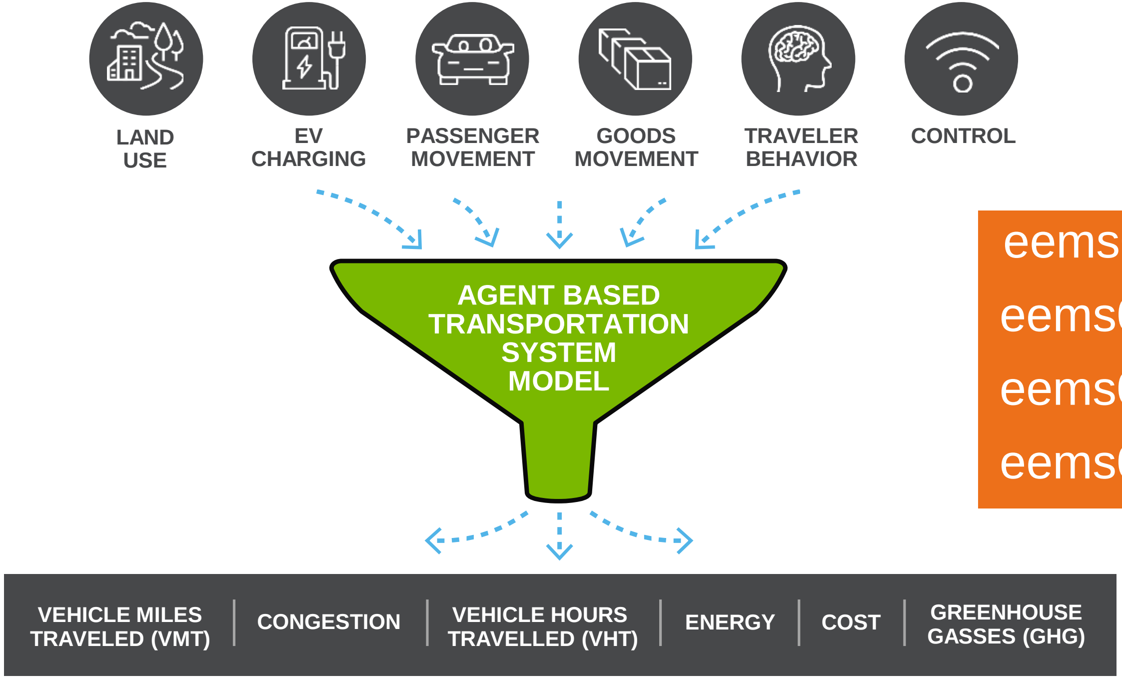
TRANSPORTATION IS A SYSTEM OF SYSTEMS

Research Portfolio



SMART MOBILITY MODELING WORKFLOW

By creating a multi-fidelity end-to-end modeling workflow, SMART Mobility researchers advanced the state-of-the-art in transportation system modeling and simulation.



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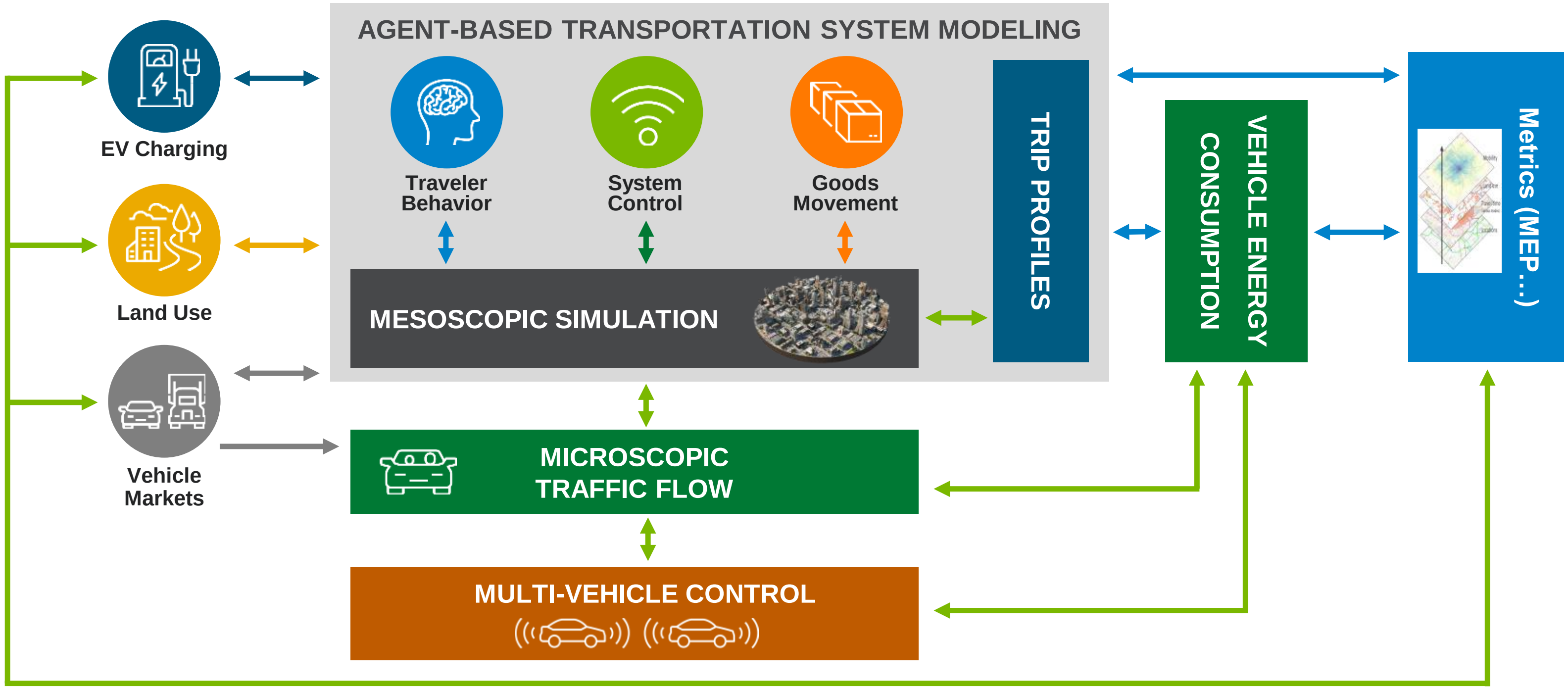
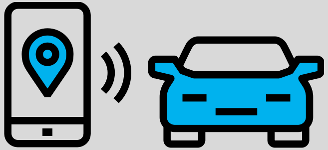
END-TO-END MODELING WORKFLOW



MOBILITY SCENARIOS CONSIDERED

A world of…

HIGH SHARING, PARTIAL AUTOMATION (A)

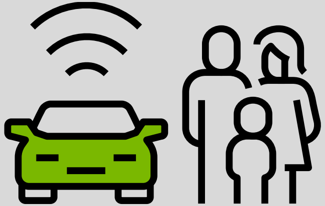


New technology enables people to significantly increase the use of **transit, ride-hailing** and **multi-modal travel. Partial automation** is introduced and is primarily used on the highway.

HIGH SHARING, HIGH AUTOMATION (B)

Technology has taken over our lives, enabling **high usage of fully automated driverless vehicles, ride-hailing and multi-modal trips**, which are convenient and inexpensive. As a result, **private ownership has decreased** and **e-commerce has increased**.

LOW SHARING, HIGH AUTOMATION (C)



Fully automated privately owned driverless vehicles dominate the market. The ability to own AVs leads to **low ride-sharing** and an expansion of urban/sub-urban boundaries, while **e-commerce has increased.**

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E-COMMERCE

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INCREASE IN E-COMMERCE LOWERS OVERALL SYSTEM VMT AND ENERGY

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Fewer shopping trips, more deliveries make the difference

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SHOPPING TRIP = 7 to 8 miles, one way

DELIVERY TRIP

1 ADDED STOP = 0.4 mile

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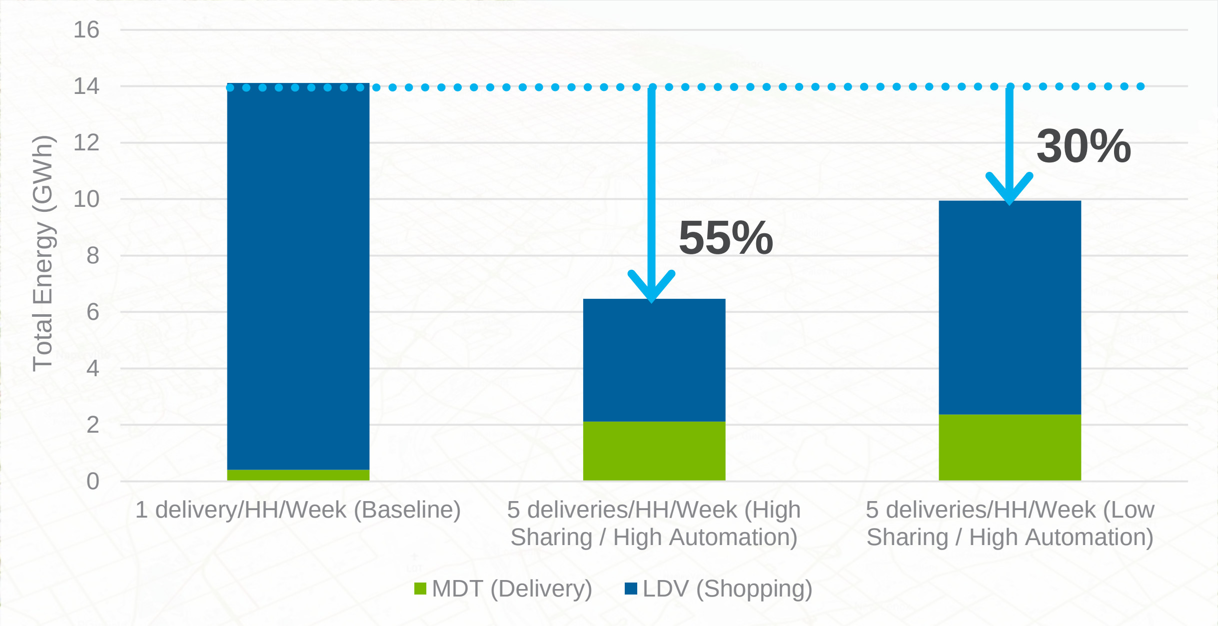
HOME DELIVERIES CAN DECREASE TRANSPORTATION ENERGY USE

Energy savings from e-commerce and vehicle technologies

CHICAGO



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CONSUMER BEHAVIOR INFORMS TRANSPORTATION MODELING

Item type influences how it is purchased

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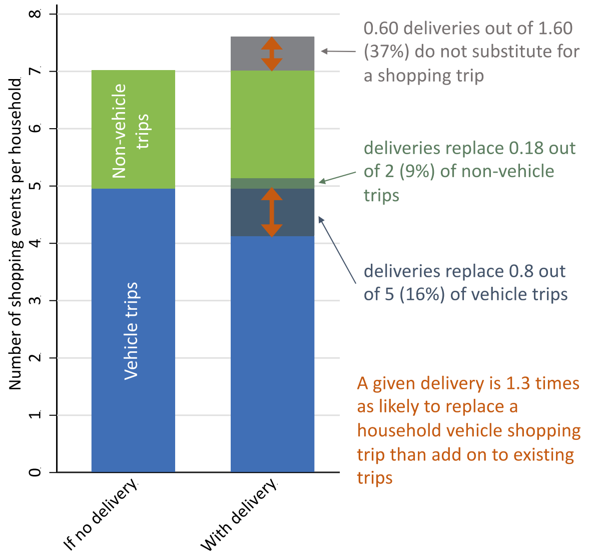

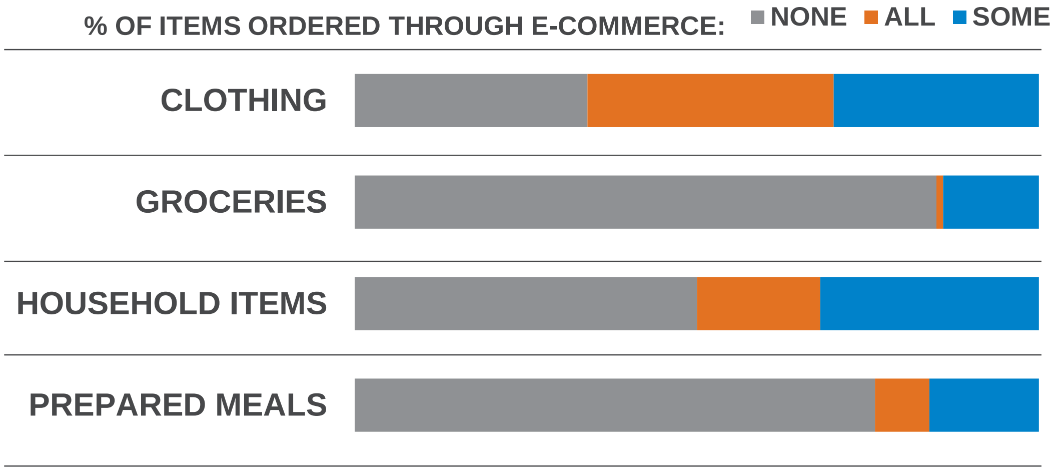

TRANSIT

TRANSIT IS CRITICAL TO MOBILITY

Absent transit, energy use and congestion increase

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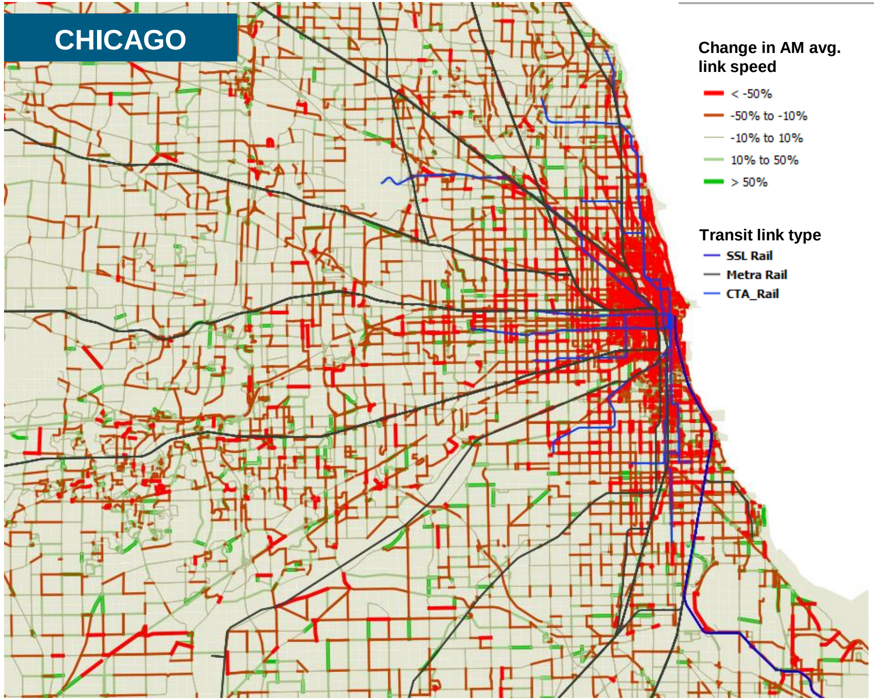

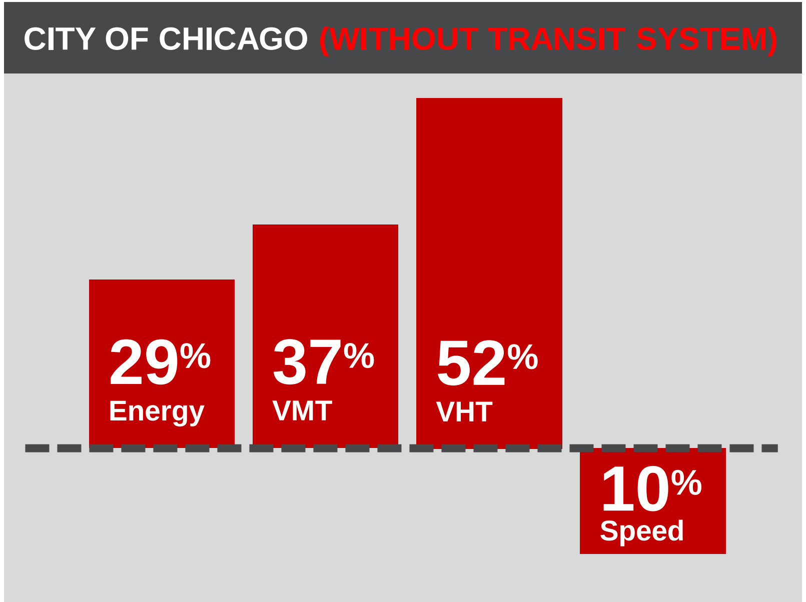

RIDE HAILING CAN COMPLEMENT OR DECREASE TRANSIT RIDERSHIP

Distance and cost influence passenger behavior

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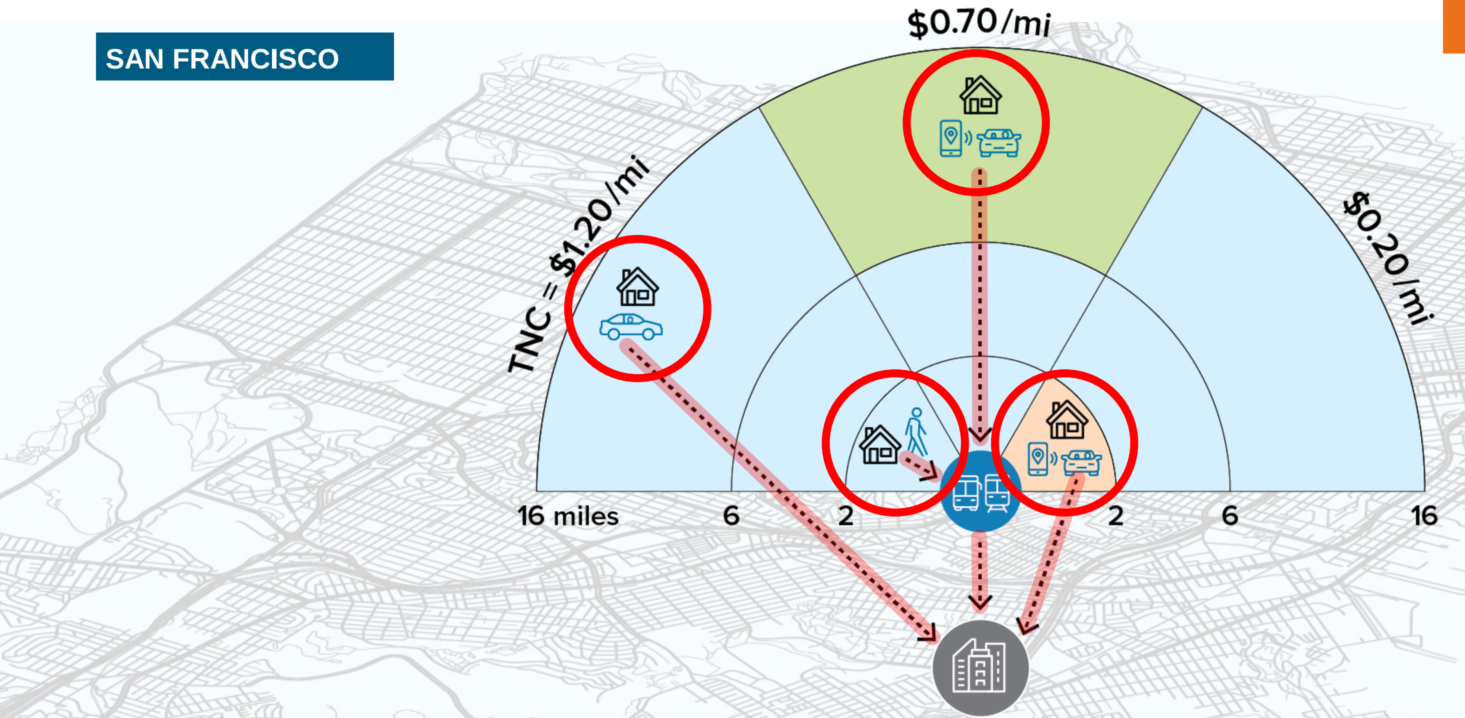

OVERALL, 6% DECREASE IN TRANSIT RIDERSHIP AT TNC=$0.20/mi

RIDE HAILING CAN COMPLEMENT TRANSIT DEPENDING ON LOCATION

Transit is key in urban core, TNC can serve surburbs

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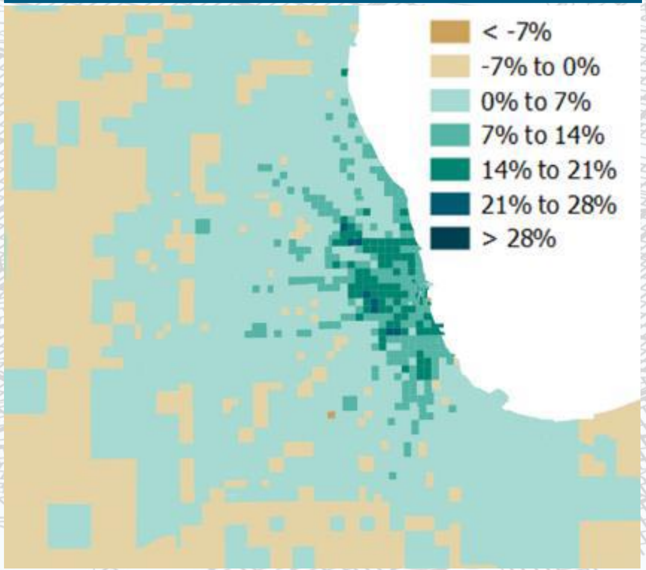
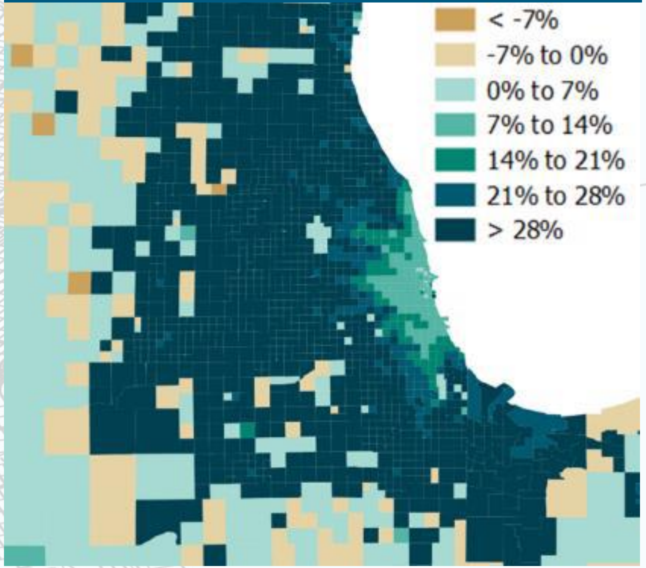
As vehicle ownership decreases:

- Increase in transit along hub/spoke lines
- Limited increase in TNC use in transit-rich areas

Transit Mode Share Change
High Sharing+Automation vs Baseline



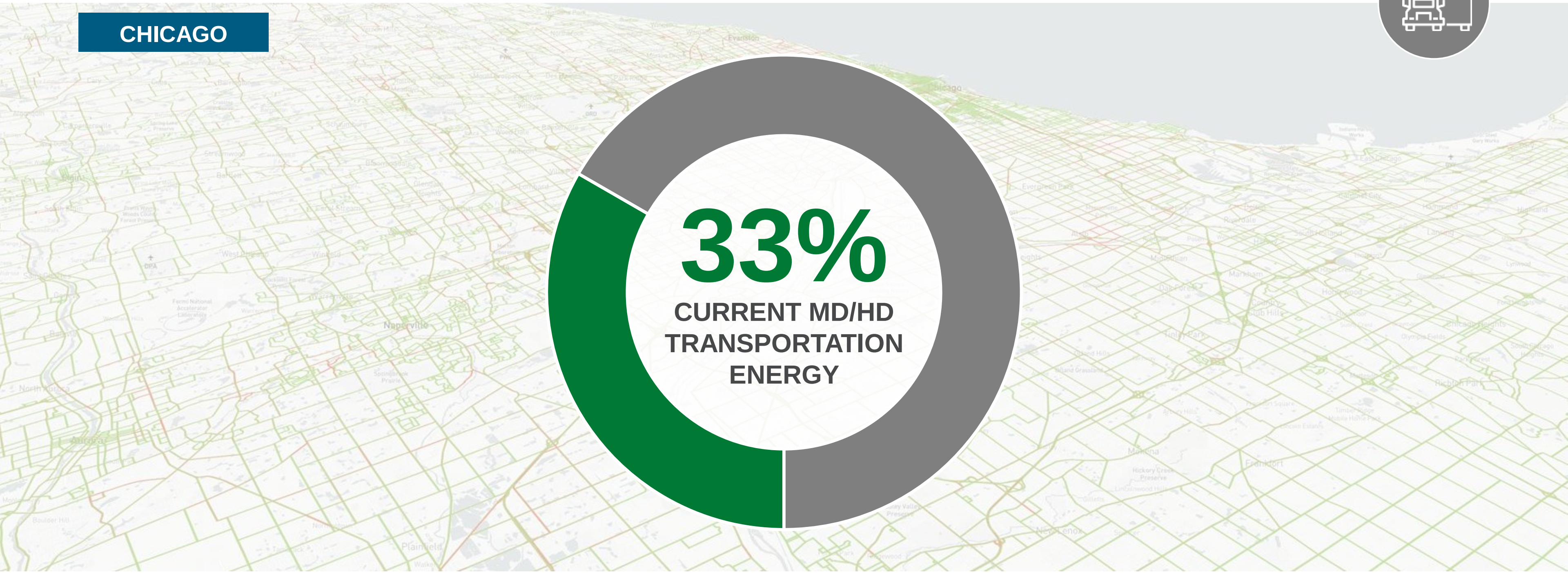
TNC Mode Share Change
High Sharing+Automation vs Baseline



MEDIUM & HEAVY-DUTY VEHICLES & FREIGHT

FREIGHT MOVEMENT WILL BE INCREASINGLY IMPORTANT

Due to increased light duty electrification and freight demand



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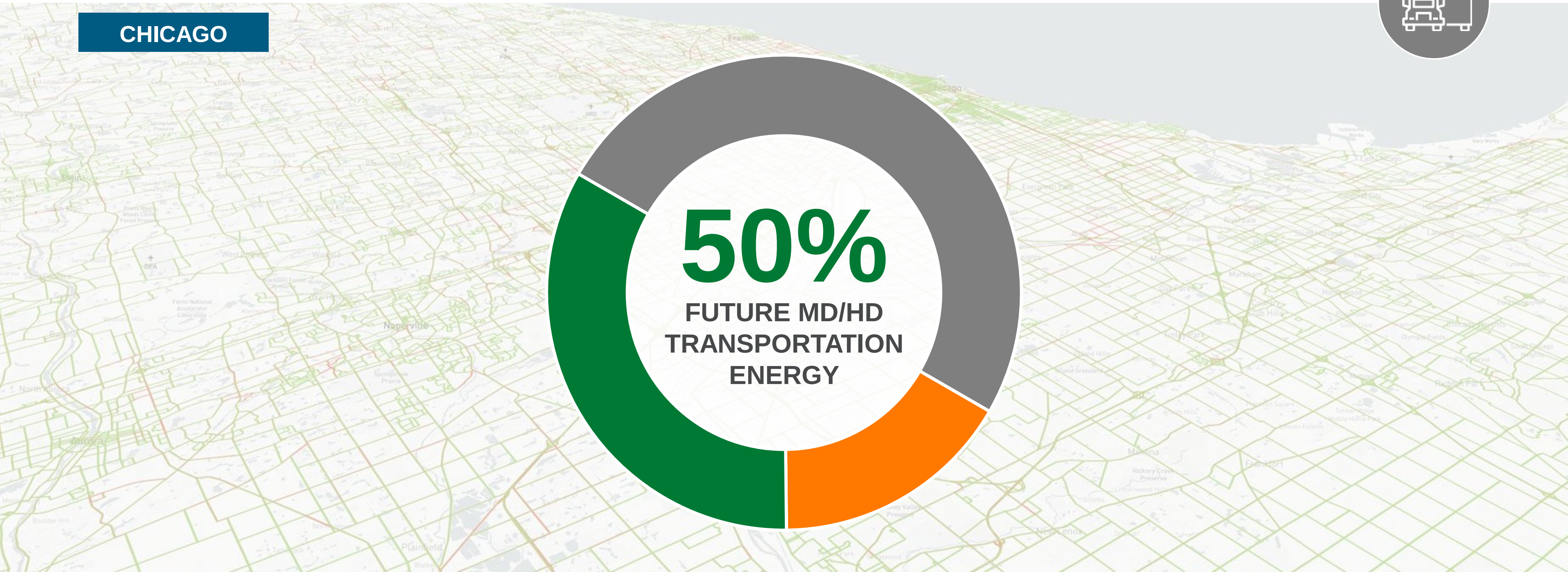
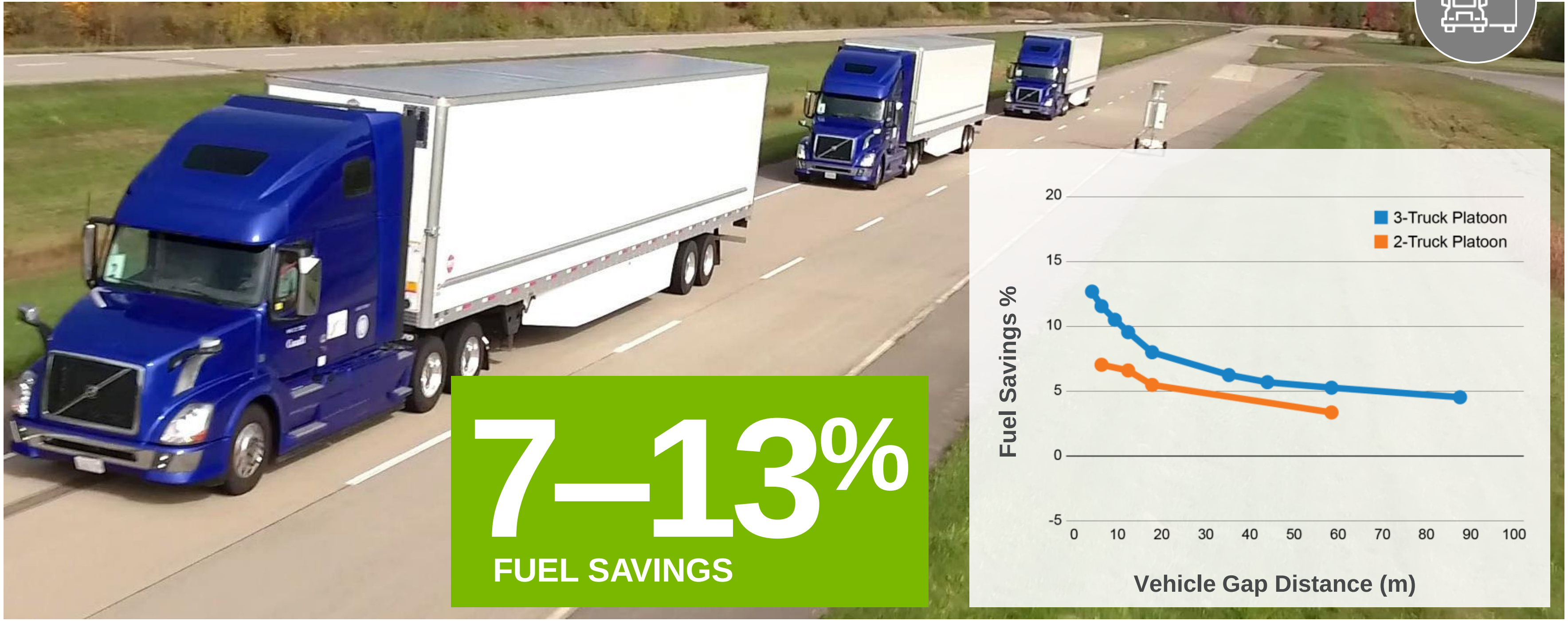


PLATOONING REDUCES TRUCK FUEL USE

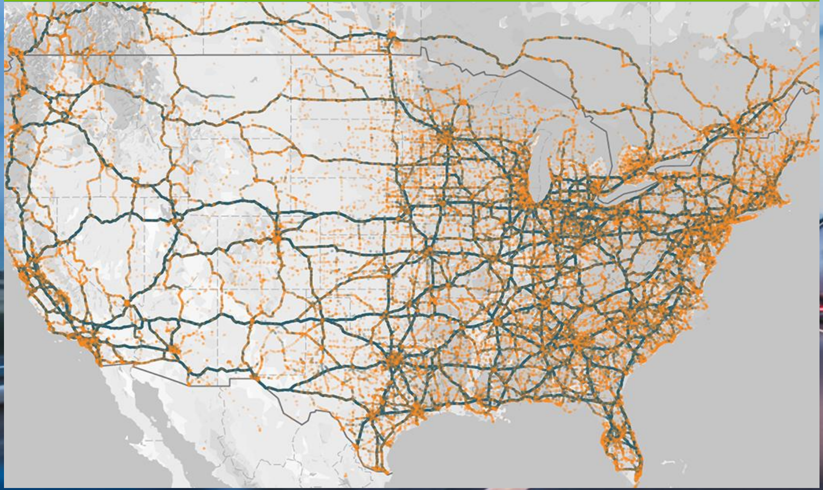
Savings depend on truck spacing, speed and position

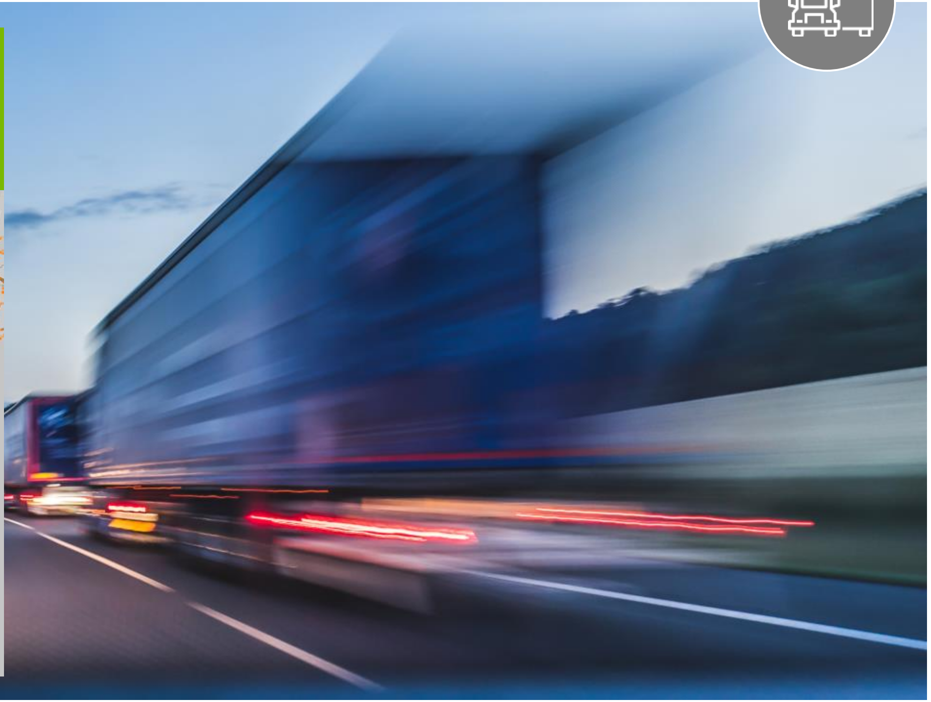


60% OF INTERSTATES AND HIGHWAY MILES MAY BE PLATOONABLE

Platooning could cut diesel use by 1–2 billion gallons

6–8% LESS FUEL CONSUMPTION FROM CLASS 7/8





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CONNECTED AND AUTOMATED VEHICLES

HIGH ACC PENETRATION MAY NEGATIVELY IMPACT TRAFFIC

Lack of communication leads to traffic instabilities, congestion

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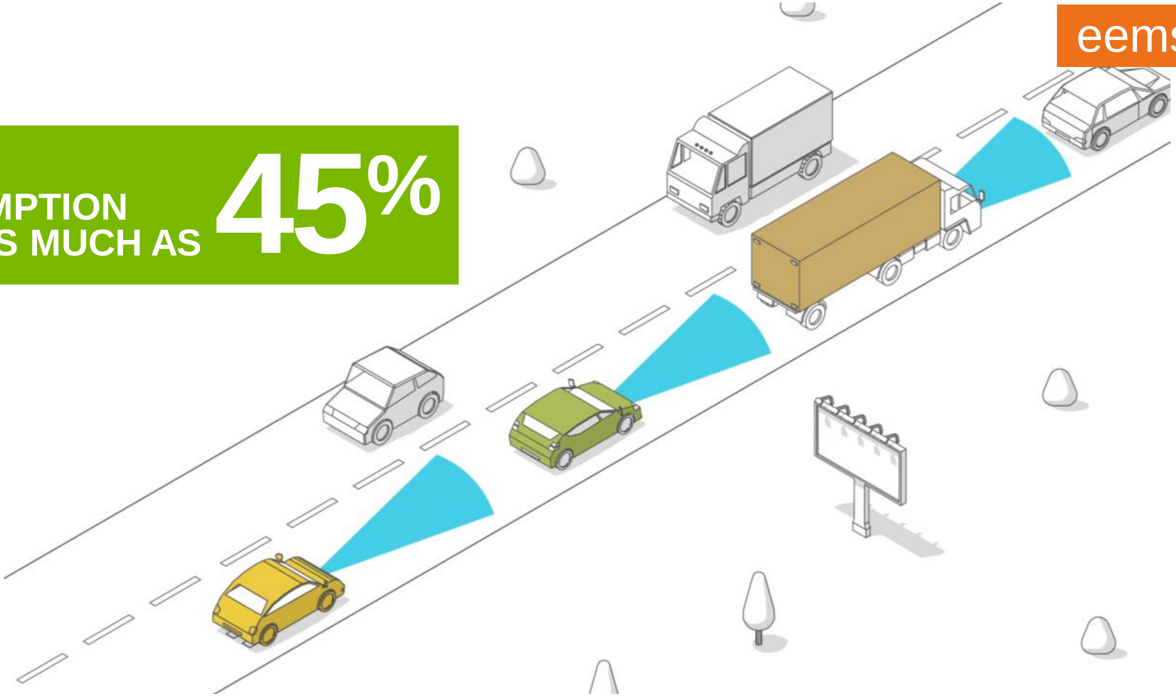
FUEL CONSUMPTION INCREASES AS MUCH AS **45%**



CACC HELPS TRAFFIC FLOW, LOWERS ENERGY USE

Vehicle communication + automation improves traffic flow

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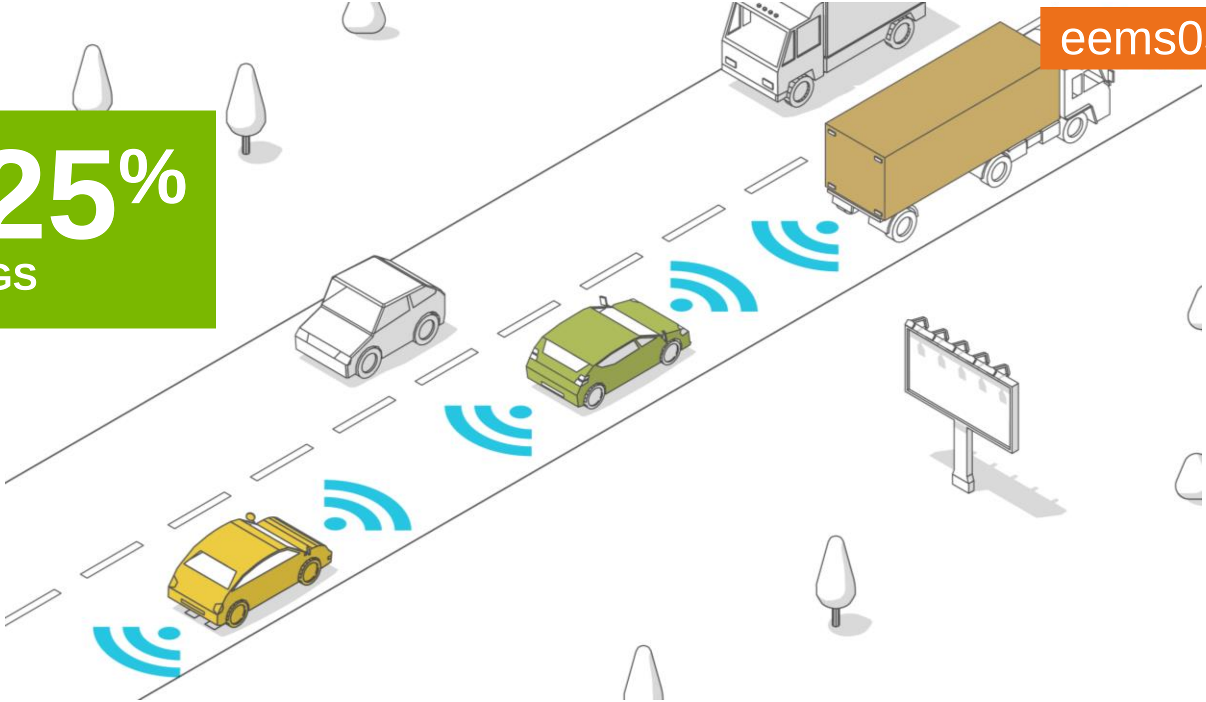
15–25%
FUEL SAVINGS



MOBILITY ENERGY PRODUCTIVITY (MEP)

A comprehensive mobility metric

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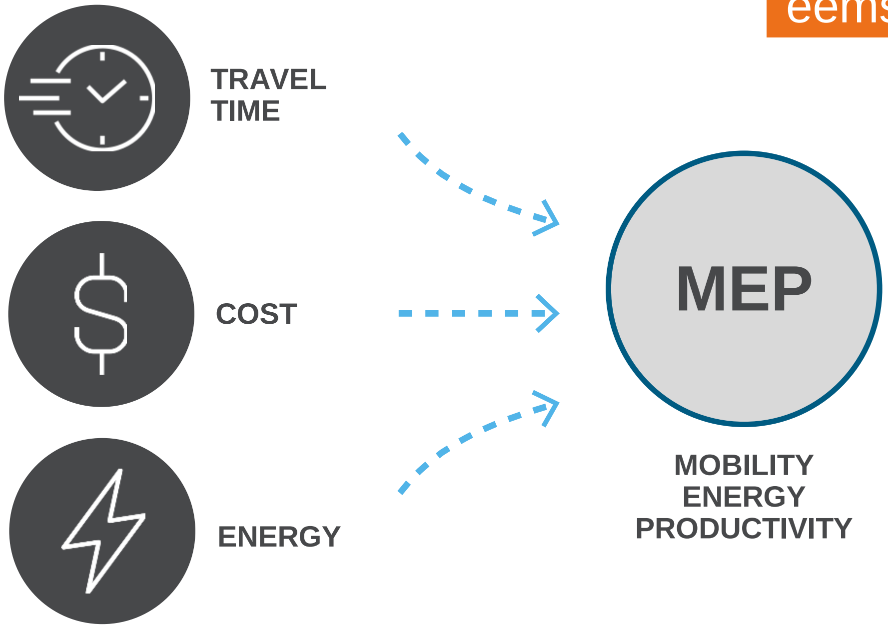
WHAT

Mobility Energy Productivity (MEP) methodology quantifies the energy, cost, and time-weighted opportunity space within a reachable area.



BASELINE MEP RESULTS FROM THE MODELING WORKFLOW

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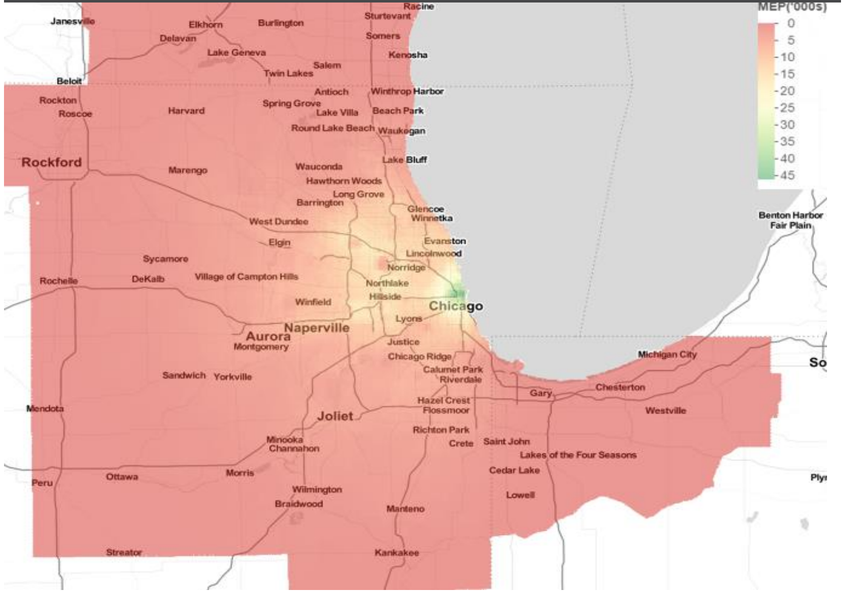
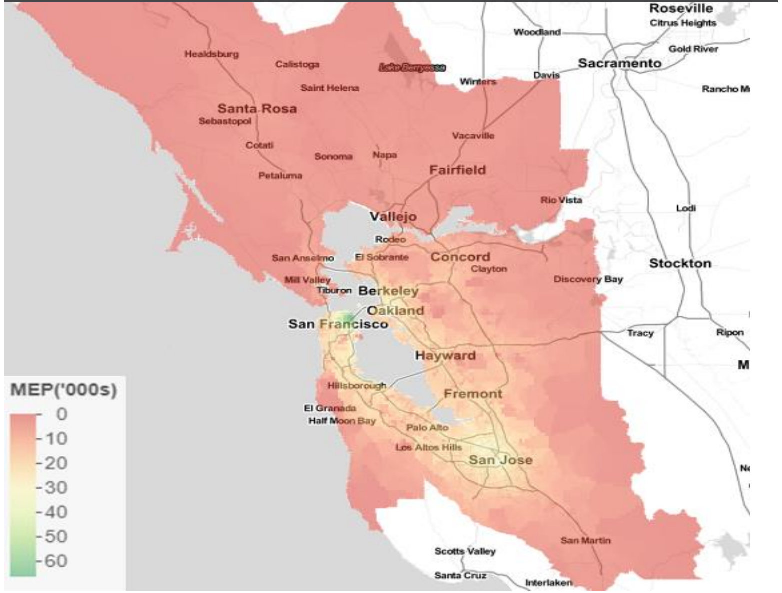


SAN FRANCISCO

eems011



MEP RESULTS FROM THE WORKFLOW SCENARIOS

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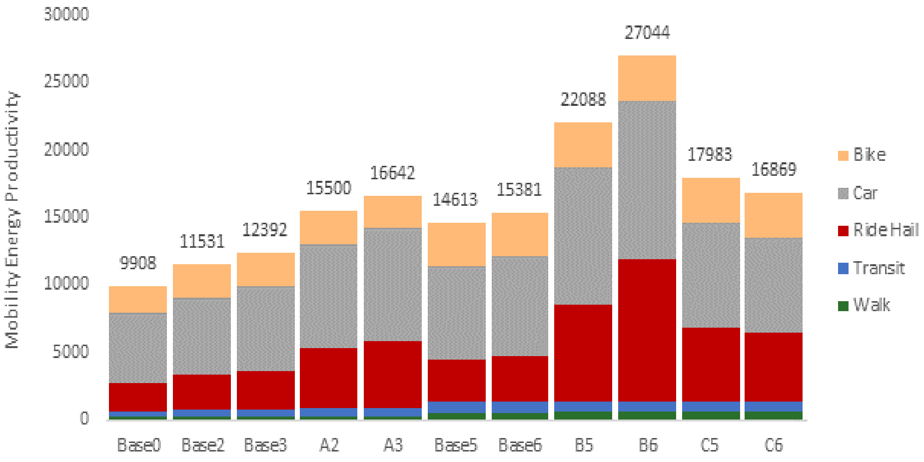
CHICAGO



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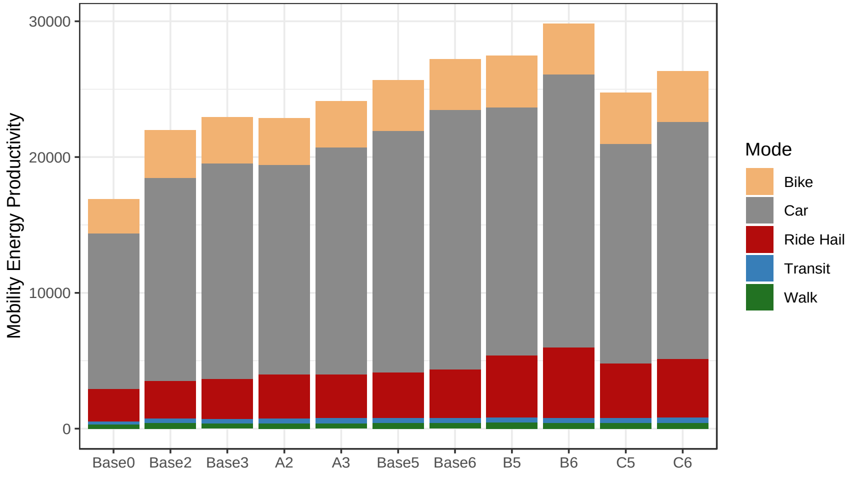

MEP RESULTS FROM THE WORKFLOW SCENARIOS

Disparate impacts depending on shared vs. private vehicle usage

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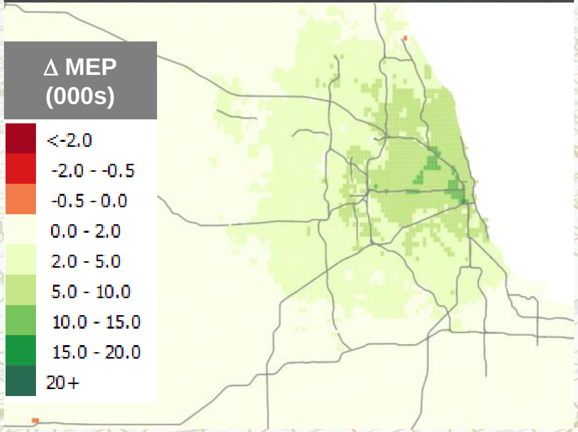
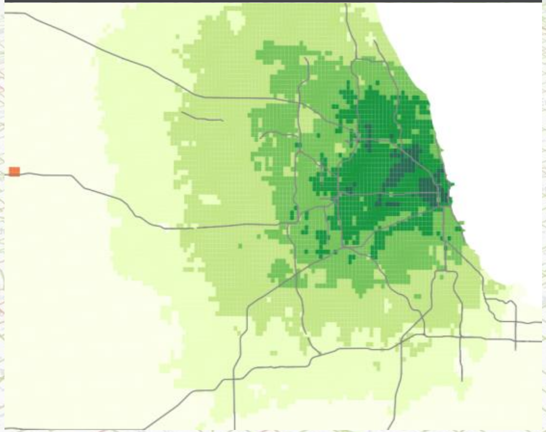
CHICAGO

∆ MEP: A (Sharing) vs. short term baseline



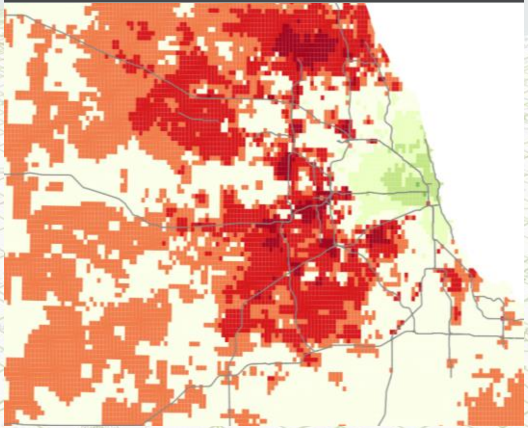
- Faster travel speed (+12%)
- Increased ridesharing
- Increased Transit use

∆ MEP: B (SAV) vs. long term baseline



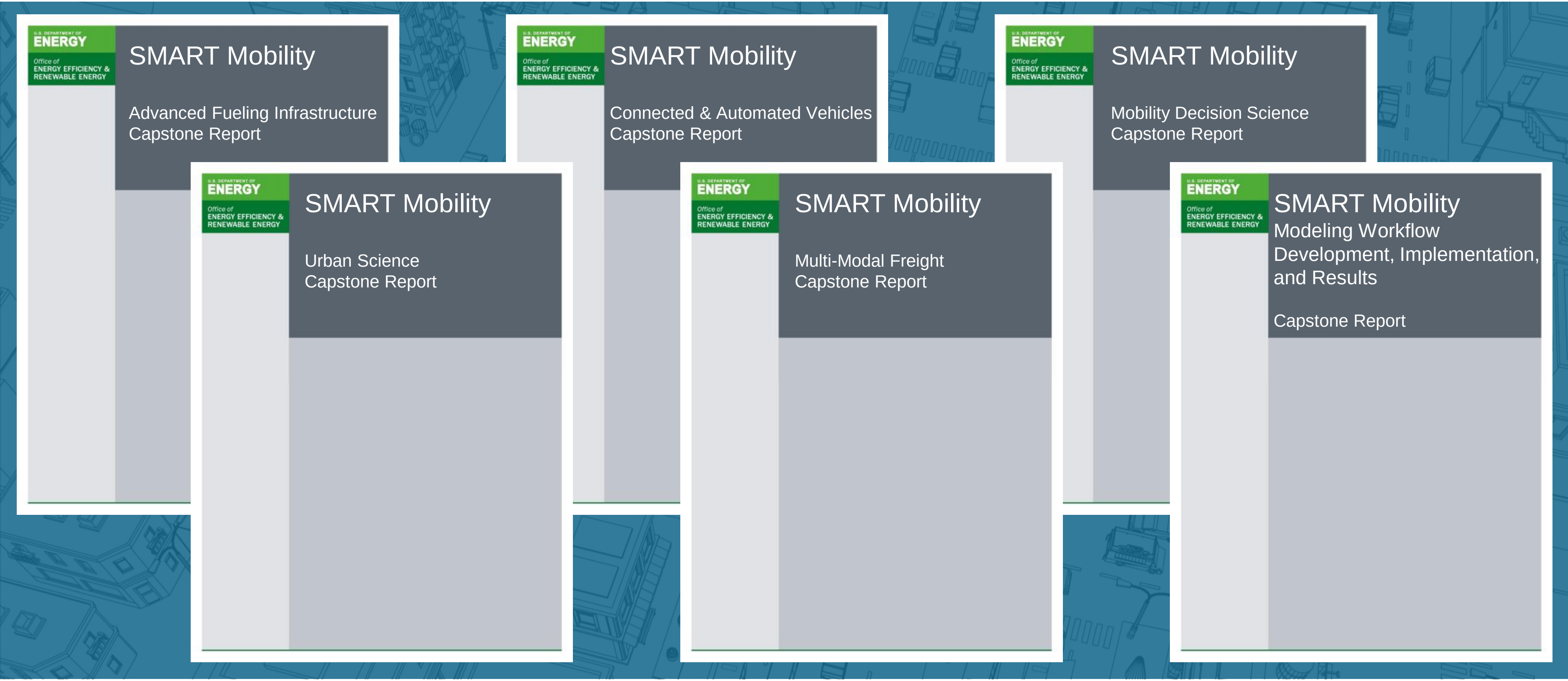
- Faster travel speed (+17%)
- Reduced TNC cost and wait
- Concentrated in transit rich areas

∆ MEP: C (AV) vs. long term baseline



- Lower travel speed in suburbs(-16%)
- In Chicago, higher SAV fleet and transit use
- **Does not account for increased productivity during travel**

SMART MOBILITY: FINAL REPORTS



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MOBILITY FOR OPPORTUNITY

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